CHAPTER 1
INTRODUCTION

1.1 CLEANING PROCESS

A Cleaning is an essential aspect of maintaining a hygienic and organized environment. Whether in residential, commercial, or industrial spaces, the cleanliness of surfaces, particularly floors, plays a crucial role in creating a healthy and visually pleasing atmosphere. This comprehensive exploration delves into the realm of cleaning, with a focus on floor cleaning and the innovative technologies behind floor cleaning machines. Maintaining a clean and healthy living or working environment is a multifaceted task that extends far beyond mere aesthetics. This comprehensive approach involves various elements, with one integral aspect being floor maintenance. The significance of floor cleaning lies not only in achieving a polished appearance but also in ensuring the longevity of flooring materials. In this detailed exploration, we delve into the intricacies of effective floor cleaning, starting from the initial preparation to the selection of appropriate cleaning solutions for different types of flooring.

Figure 1.1 Stick Mopper

Effective floor cleaning necessitates a meticulous beginning, involving the clearance of areas from furniture and debris to facilitate a thorough and efficient cleaning process. The foundational step of sweeping or vacuuming eliminates loose dirt that could potentially scratch or damage floors during

subsequent cleaning procedures. Once the surface is adequately prepared, the critical decision of choosing the appropriate cleaning solution comes into play. Different flooring materials, such as hardwood, tile, or carpet, each demand specific cleaners tailored to preserve their unique integrity and characteristics. Hard floors, for instance, benefit from the use of a mop or microfiber cloth in conjunction with a suitable cleaning agent. This method not only addresses visible dirt but also proven effective in combating bacteria and allergens, contributing to a healthier indoor environment. On the other hand, require a different set of maintenance practices, including regular vacuuming and periodic deep cleaning to eliminate embedded dirt and refresh the fibers. Adhering to manufacturer recommendations paramount in preventing unintended damage and ensuring the longevity of these flooring materials.

Figure 1.2 Numatic Twintec Cable Tt1840g Floorcare Machine

As we delve deeper into the realm of sustainable living, an additional layer of consideration arises – the choice of eco-friendly cleaning products. Embracing such products aligns with broader sustainability practices, safeguarding both the environment and the health of occupants. This expanded perspective highlights the interconnectedness of cleaning practices with larger ecological concerns. Furthermore, the value of regular floor maintenance extends beyond hygiene and aesthetics; it directly impacts the overall lifespan of the flooring, thereby offering potential cost savings by minimizing the need

for premature replacements. This financial aspect underscores the long-term economic benefits of investing time and effort into proper cleaning and maintenance routines.

1.2 INTRODUCTION TO FLOOR CLEANING MACHINE

Floor cleaning machines, known as floor scrubbers or sweepers, automate and improve floor cleaning efficiency. They encompass various types, such as floor scrubbers using rotating brushes, floor sweepers for loose debris, steam cleaners employing steam for disinfection, and buffing machines for polishing floors.

Key components include diverse brushes/pads, squeegees for collecting dirty water, solution tanks for cleaning agents, recovery tanks for storing dirtied water, and a drive system powering machine movement.

These machines draw power from electric sources for indoor use, battery power for mobility in larger areas, and propane/gas for outdoor or industrial applications. Advantages lie in their efficiency, ensuring consistent cleaning results, versatility across different floor types, and labor savings by reducing manual effort. They find applications in commercial spaces like offices and malls, industrial settings such as warehouses, and residential use for homes with extensive floor areas.

Maintenance involves regular cleaning, inspecting and replacing brushes as needed, and proper battery maintenance for battery-powered models. Safety considerations encompass operator training, careful chemical handling for machines using cleaning solutions, and regular maintenance checks.

Environmental impact considerations include water efficiency in some models and energy efficiency, contributing to a more sustainable cleaning process. Future trends indicate the integration of smart technology with the Internet of Things (IOT) for remote monitoring, a growing focus on eco-friendly cleaning solutions, and advancements in autonomous floor cleaning. Challenges include ensuring adaptability to various floor types, addressing the initial high cost, and managing storage space for some machines.

1.3 HISTORY OF FLOOR CLEANING

The history of floor cleaning dates back centuries, evolving alongside advancements in technology and societal changes. Here's a concise overview:

1.3.1 Early Methods

In ancient times, floor cleaning was a manual and labor-intensive process. People utilized simple tools made from natural materials for this purpose. Brooms, crafted from twigs or other plant fibers, were the primary instrument for sweeping away dirt and debris. In more affluent households, servants played a crucial role in maintaining cleanliness by manually polishing and caring for floors. This manual approach to floor cleaning was a fundamental aspect of daily life, reflecting the available resources and technology of the time.

Figure.1.3 Karcher Compact/ Push Scrubber Dryer BR 30/1cbp

1.3.2 Renaissance Period

The Renaissance marked a shift in floor cleaning methods, particularly in wealthier European households. Mops made of yarn or fabric strips began to replace or complement traditional brooms for wet cleaning. This innovation allowed for a more effective removal of stains and spills, contributing to improved hygiene. During this period, the choice of flooring materials, such as

stone or wood, became intertwined with notions of social status. Cleanliness, including well-maintained floors, was indicative of a household's prosperity.

1.3.3 Industrial Revolution (18^{th}-19^{th} centuries)

The Industrial Revolution brought about transformative changes in various industries, including cleaning. Brooms and mops underwent improvements with the adoption of more durable and efficient materials. This era saw the mass production of cleaning tools, making them more accessible to a broader population. The availability of standardized cleaning tools marked a significant step towards systematizing floor cleaning practices.

1.3.4 In 19^{th} Century

The early 20^{th} century witnessed a leap in floor cleaning technology with the introduction of motorized vacuum cleaners. This innovation revolutionized the 8process by providing a more efficient and less labor-intensive means of removing dust and debris. Additionally, the practice of waxing and polishing became commonplace, especially for hardwood floors. This not only enhanced the aesthetic appeal of floors but also served as a protective measure against wear and tear

Figure.1.4 Numatic Twintec Cable Tt6650g Floorcare Machine

1.3.5 Mid-20^{th} Century

The mid-20th century ushered in the era of electric floor scrubbers, signifying a shift towards automation in floor cleaning. These machines,

equipped with rotating brushes or pads, offered a more systematic and scalable approach to cleaning in industrial and commercial spaces. The adoption of electric floor scrubbers represented a departure from purely manual labor, leading to increased efficiency and improved cleanliness standards in larger settings.

1.3.6 Late 20th Century

Carpeted floors gained popularity in the latter part of the 20th century, necessitating specialized cleaning methods. This led to the development of vacuum cleaners designed specifically for carpets, addressing the unique challenges posed by this flooring type. Concurrently, advances in chemical cleaning solutions further enhanced the effectiveness of floor cleaning processes, providing more targeted solutions for different flooring materials

Figure.1.5 Tomcat XR Rider Scrubber 40 Cylindrical

1.3.7 In 21st Century

The 21st century brought about a paradigm shift in floor cleaning with the advent of modern floor cleaning machines. Robotic cleaners and advanced scrubbers have redefined the industry by offering unprecedented levels of automation and efficiency.

The emphasis on green cleaning practices reflects a growing awareness of environmental impact, with an increasing demand for eco-friendly and sustainable solutions.

Figure.1.6 Sheltland Floorsmith

1.3.8 Smart Technology Integration

Recent trends in floor cleaning involve the integration of smart technology. This includes the incorporation of Internet of Things (IOT) features into cleaning machines, enabling remote monitoring and control. IoT-enabled devices contribute to more efficient and data-driven cleaning processes, allowing for personalized and optimized cleaning routines.This integration aligns with broader trends in smart home technology, providing users with greater convenience and control over their cleaning processes.

The evolution of floor cleaning illustrates a continuous adaptation to technological innovation, societal expectations, and environmental considerations. From ancient manual methods to cutting-edge smart technologies, the industry has evolved to meet the changing needs and preferences of individuals and businesses alike.

1.4 METHODS OF FLOOR CLEANING

The diverse array of floor cleaning methods caters to the specific needs of various floor surfaces, providing effective solutions for maintenance and hygiene. Each method serves a unique purpose, adapting to different levels of soiling and desired outcomes.

1.4.1 Sweeping

A timeless practice, relies on brooms, brushes, or sweepers to diligently remove loose debris, dust, and dirt from surfaces such as tile, hardwood, or concrete. This method, rooted in simplicity, is ideal for daily maintenance, preventing the accumulation of superficial dirt.

Figure No.1.7 Spin Mop Wringer Cleaner

1.4.2 Mopping

Introduces a dampened mop or microfiber cloth into the cleaning arsenal. This versatile technique is suitable for a broad spectrum of surfaces, including tile, linoleum, and hardwood. It serves as a fundamental routine cleaning method, effectively removing everyday grime and maintaining surface hygiene

1.4.3 Vacuuming

Steps into play for carpets, area rugs, and floors laden with loose dirt. Leveraging suction power, vacuum cleaners efficiently extract dust and debris, safeguarding carpeted areas and improving indoor air quality

1.4.4 Steam Cleaning

Takes a technologically advanced route, harnessing the power of hot steam to deep clean and sanitize surfaces, particularly tile and grout. This method excels in eliminating dirt and stains without the reliance on chemical agents, offering an eco-friendly alternative.

Figure .1.8 Walk behind Karcher Scrubber Machine

1.4.5 Scrubbing

Takes a more aggressive stance, employing scrub brushes or floor scrubber machines with rotating brushes to tackle stubborn dirt and grime. Commonly utilized in commercial settings for high-traffic or heavily soiled areas, this method ensures a thorough clean and floor restoration.

1.4.6 Polishing and Buffing

A touch of glamour, enhancing the shine of hard floors using floor buffers or polishing machines. Typically applied to surfaces like hardwood, marble, and terrazzo, this method maintains a glossy finish, restoring luster to the floor.

1.4.7 Stripping and Waxing

Cater to vinyl, linoleum, or certain tile floors, involving the removal of old wax layers, dirt, and stains. The subsequent application of a new wax layer not only protects but enhances the overall appearance of the floor.

1.4.8 Deep Cleaning

Emerges as a comprehensive approach, combining various methods such as scrubbing and steam cleaning to eradicate deeply embedded dirt and grime. Ideal for periodic or intensive cleaning, this method revitalizes heavily soiled floors and tackles stubborn stains.

1.4.9 Spot Cleaning

Hones in on specific blemishes, utilizing specialized stain removers or cleaning solutions. Targeting isolated areas rather than the entire floor, this method is effective in maintaining the overall appearance by addressing localized stains

Figure.1.9 Numatic Twintec Cable Tt4045g Floorcare Machine

1.4.10 Green Cleaning

Adopts an eco-conscious stance, focusing on environmentally friendly practices and sustainable methods. Applicable across various floor surfaces, this method minimizes the environmental impact of cleaning activities, aligning with a broader commitment to green living In navigating the array of floor cleaning methods, the key lies in selecting the most suitable technique based on the unique characteristics of the floor surface, the level of soiling, and the desired cleaning outcome. A harmonious integration of these methods within a routine maintenance plan ensures that floors not only remain clean but also contribute to a healthy and aesthetically pleasing environment

1.5 IMPORTANCE OF FLOOR CLEANING

The importance of floor cleaning extends beyond mere aesthetics; it plays a critical role in maintaining a healthy, safe, and welcoming

environment. Here are key reasons highlighting the significance of regular floor cleaning:

Figure.1.10 Bissell Little Green Carpet Cleaner

1.5.1 Hygiene and Health

Floors, especially in high-traffic areas, can harbor bacteria, viruses, and allergens. Regular cleaning helps prevent the growth and spread of harmful microorganisms, contributing to a healthier indoor environment.

1.5.2 Safety Clean

Floors reduce the risk of slips and falls. Removing debris, spills, or slippery substances promotes a safer environment, particularly in homes, workplaces, and public spaces.

1.5.3 Prolonged Floor Lifespan

Regular cleaning helps prevent the accumulation of abrasive particles that can wear down and damage flooring materials. This preservation extends the lifespan of the floors, reducing the need for costly replacements.

1.5.4 Enhanced Indoor Quality

Dust and allergens settle on floors over time. Effective cleaning, including vacuuming and mopping, removes these particles, contributing to improved indoor air quality and reducing respiratory issues.

Figure.1.11 Karcher B 140r Bp Ride on Scrubber

1.5.5 Professional Image

Clean and well-maintained floors contribute to a positive first impression. Whether in commercial settings or homes, aesthetically pleasing floors create a welcoming and professional atmosphere.

1.5.6 Productivity in Workplaces

In workplaces, clean and organized surroundings contribute to a positive work environment. Employees are likely to be more productive, and clients or visitors may perceive the space more favorably.

1.5.7 Compliance with Standards

Many industries and businesses are subject to health and safety regulations that include cleanliness standards. Regular floor cleaning helps ensure compliance with these regulations and avoids potential legal issue

1.5.8 Reduction of Pest Infestation

Crumbs, spills, and debris on floors can attract pests. Regular cleaning eliminates potential food sources, reducing the risk of pest infestations in both residential and commercial spaces.

1.5.9 Odor Control

Lingering odors on floors can impact the overall atmosphere of a space. Cleaning helps eliminate dirt and spills that contribute to unpleasant smells, promoting a fresh and clean environment.

1.5.10 Maintaining Property Value

Regular floor maintenance, including cleaning, protects the value of a property. Well-maintained floors contribute to the overall condition and appeal of a home or building.

1.5.11 Prevention of Strains and Drainage

Prompt cleaning of spills and stains prevents them from becoming permanent and causing irreversible damage to floors. This practice helps maintain the appearance and integrity of the flooring. Floor cleaning is essential for creating a safe, healthy, and visually appealing environment. From preventing the spread of infections to ensuring compliance with regulations and enhancing the longevity of flooring materials, regular floor cleaning is a fundamental aspect of overall maintenance and well-being.

Figure.1.12 Windsor Chariot Iscrub Stand Up Scrubbers

1.6 CHOOSING OF FLOOR CLEANER

1.6.1 Floor Type

Consider the type of flooring you have (e.g., hardwood, tile, carpet). Different floor materials may require specific cleaning products to maintain their integrity and appearance.

1.6.2 Cleaning Needs

Assess the level of soiling and specific cleaning requirements. High-traffic areas or places prone to spills may need more robust cleaning solutions.

Figure.1.13 Ku85 Ride On Scrubber Drier Battery Operated

1.6.3 Environmental Impact

Choose environmentally friendly and biodegradable cleaning products to minimize the ecological footprint. Look for certifications indicating eco-friendly formulations.

1.6.4. Allergen Considerations

For individuals with allergies or sensitivities, opt for floor cleaners that are hypoallergenic and free from harsh chemicals or fragrances.

1.6.5 Compatibility with Equipment

If using floor cleaning machines, check compatibility with the chosen cleaner. Certain machines may require specific types of cleaning solutions.

1.6.6 Residue Free Formulation

Look for floor cleaners that leave little to no residue. Residue can attract dirt and affect the appearance of the floor over time.

1.6.7 Multi Surface Versatility

Choose versatile cleaners that can be used on multiple surfaces. This can streamline your cleaning routine and reduce the need for multiple products.

1.6.8 Ease Use

Consider the convenience of application. Some cleaners come in ready-to-use spray bottles, while others require dilution. Choose a format that fits your cleaning preferences.

1.6.9 Scent Preference

If using scented cleaners, consider personal preferences and sensitivities. Apt for mild or neutral scents to avoid overwhelming odors in your living or working space.

1.6.10 Budget Consideration

Evaluate the cost-effectiveness of the cleaner. While quality is crucial, choose a product that aligns with your budget for regular use.

1.7 CHALLENGES AND FUTURE TRENDS IN FLOOR CLEANING

1.7.1 Adaptability to Various Floor Type

Ensuring that floor cleaning products are suitable for a wide range of flooring materials. Development of versatile, adaptable formulas that cater to diverse floor surfaces, reducing the need for specialized products.

1.7.2 Environmental Sustainability

Balancing the efficacy of floor cleaners with eco-friendly formulations. Continued emphasis on sustainable ingredients, packaging, and practices. More innovations in green cleaning solutions.

1.7.3 Smart Cleaning Technologies

Integrating smart technologies into floor cleaning products. Increased use of smart features, such as sensors and connectivity, for automated and data-driven cleaning experiences.

Figure.1.14 Soma Floor Mopping Machine

1.7.4 Antimicrobial Solutions

Addressing the need for enhanced disinfection without relying on harsh chemicals. Development of effective antimicrobial solutions that are gentle, safe, and meet hygiene standards.

1.7.5 Waste Reduction

Minimizing packaging waste and promoting responsible disposal. Adoption of refillable or concentrated cleaning products to reduce packaging waste. Increased focus on circular economy principles.

1.7.6 Personalized Cleaning Solutions

Catering to individual preferences and specific cleaning needs. Customizable cleaning solutions, possibly through IOT integration, allowing users to tailor cleaning routines based on their unique requirements

1.7.7 Regulatory Compliance

Adapting to evolving regulations and standards in the cleaning product industry. Continued efforts to align with and exceed regulatory requirements, ensuring products are safe for consumers and the environment.

1.7.8 Education and Awareness

Informing consumers about the importance of choosing suitable floor cleaners and their impact on health and the environment. Increased educational initiatives promoting informed and responsible choices in floor cleaning products. These considerations and embracing emerging trends, individuals can contribute to effective and sustainable floor maintenance practices, ensuring cleanliness without compromising on health or the environment.

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Figure.1.15 Ruby 50 Floor Mopping Machine

CHAPTER 2
LITERATURE SURVEY

2.1 LITERATURE REVIEW

Rahul Gajbhiye et al[1], 2020 The development of a manual floor cleaning machine to address the challenges associated with the complexity, cost, and operational charges of automated floor cleaning machines. The designed machine aims to provide efficient wet and dry floor cleaning with a storage box for dust. It prioritizes simplicity, cost-effectiveness, and ease of use, operating on electricity without requiring training. The introduction emphasizes the essential need for cleaning in the current generation, particularly in households. The machine combines the functions of a vacuum cleaner, dryer, and mop, focusing on weight, cost, flexibility, and ease of handling. The methodology involves various components like a DC motor, vacuum cleaner, water pump, circular and roller brush, mop, SMPS, and hot air blower, mounted on a mild steel frame. Advantages include cost-effectiveness, user-friendliness, minimal maintenance, and the ability to perform both dry and wet cleaning. The conclusion highlights the machine's capability to address limitations in existing floor cleaning machines, particularly its effectiveness in wet conditions. The future scope suggests potential modifications such as adding a battery and automatic operating system for improved functionality and addressing current design issues.

Mahesh P. Deore et al[2], 2019 Discusses the evolution of floor cleaning machines, ranging from manual operation to the development of automatic floor cleaners. Highlighting the need for efficient cleaning in urban areas, the focus is on creating a cleaner that can navigate autonomously, employing ultrasonic sensors to detect obstacles, vacuuming dust with attached brushes, and preventing falls from heights. The study emphasizes the importance of addressing challenges in road cleaning, pipe cleaning, and debris removal, introducing a multipurpose floor cleaner with functions like scrubbing, blowing, gripping, and pipe cleaning. The

paper explores existing methodologies, including manually operated floor cleaners and multipurpose floor cleaners mounted on wooden frames. The multipurpose cleaner consists of units like chain drive, pipe cleaner, arm and gripper, scrubber, and a solar panel. The conclusion emphasizes the transition from manual to automatic floor cleaning systems, with a focus on energy efficiency and cost savings, advocating for the need for an automated floor cleaner that incorporates additional features such as UV light sanitation.

M. Ranjit Kumar et al[3], 2015 Underscores the importance of effective cleaning and sanitizing in protecting human health and preventing pest infestations. It addresses the specific need for cleaning bus stands and railway stations, often littered with debris. Acknowledging the popularity of floor cleaning robots, the study focuses on the development and evaluation of a manually operated floor cleaning machine in India, aiming to reduce labor dependence. The work incorporates a comprehensive analysis, including three-dimensional modeling and finite element method analyses using ANSYS software, ensuring the machine's effectiveness for both dry and wet cleaning. The design includes a pedal-operated body with attachments for dry cleaning (sweeping) and wet cleaning (mopping), demonstrating its suitability for smooth surfaces. The conclusion emphasizes the machine's viability as an alternative during power crises and verifies its safety through finite element analysis, ensuring induced stresses are within allowable limits.

Ritvick Ghosh et al[4], 2016 Introduces automatic floor scrubbers as floor cleaning machines with rotary or cylindrical scrubbing heads, designed to efficiently dispense cleaning solution, scrub the floor, and vacuum up the residue. The problem statement addresses issues associated with electric floor moppers in large commercial areas, emphasizing the dependence on electricity, wire-related hazards, and inconsistent power supply. The objective is to design a non-electric, mechanical floor mopper to address these concerns, reducing initial investment costs. The design methodology involves market analysis, material selection, conceptual design, analysis, production, testing, and evaluation. A cost and weight

comparison with electric floor moppers highlights the project's affordability and portability. The discussion suggests potential modifications for future enhancements, such as incorporating additional mops, a vacuum pump, increased tank capacity, retrofitting an electric motor, and using more durable mop materials for outdoor cleaning applications

Harshvardhansinh Parmar et al[5], 2019 Explores the development of an automatic floor-cleaning robot designed to enhance the efficiency of mopping operations, reducing cleaning costs and human effort. The robotic cleaner addresses the limitations of conventional methods, introducing a portable, low-maintenance, and cost-effective solution. Utilizing microcontroller technology, IR sensors, ultrasonic sensors, Bluetooth modules, stepper motors, and a mopping mechanism, the robot aims to autonomously complete complex cleaning tasks. The proposed system follows a zigzag cleaning path, demonstrating effectiveness with a cleaning time of 13 minutes for a 3.048 m × 3.048 m room. The robot incorporates obstacle detection, providing smooth cleaning operations. The results showcase promising applications in home automation and various environments, presenting a potential solution for time-saving and assisting physically disabled individuals. The Blynk IoT app facilitates manual control of the robot. The project concludes with a cost-effective estimate of INR 5000 for the floor mopping robot, highlighting its economic viability and practicality.

Shreyash J. Sagaonkar et al[6], 2020 Focuses on the design and fabrication of a Bluetooth-operated floor cleaning machine to address the challenges of manual and time-consuming cleaning processes. The aim is to modernize floor cleaning for wet and dry surfaces, making it efficient and cost-effective. The literature survey emphasizes the significance of Bluetooth control technology in similar applications, highlighting the benefits of automation and reduced manual effort. The identified problem revolves around the persistence of dust and dirt particles during manual cleaning, leading to increased effort and time consumption. The developed Bluetooth-controlled robot demonstrates satisfactory performance in traversing smooth surfaces, offering flexibility through a mobile

application. The assembled floor cleaning machine successfully incorporates commands for brush rotation and water spraying, achieving the intended cleaning results. The project concludes with a promising outlook for future enhancements and optimizations in sensing technology and mechanical components, presenting a successful venture in the field of robotic floor cleaning.

S.Mathivanan et al[7], 2022 Addresses the significance of cleanliness in daily life, emphasizing the need for effective floor cleaning to prevent the spread of diseases, especially in the context of the COVID-19 pandemic. The focus is on developing a manually operated floor cleaning machine as an alternative to conventional electrically powered devices, considering the power crisis in many places in India. The machine incorporates features such as water supply, scrubbing, and a fan for comprehensive floor cleaning. The system is designed with AC motors, dual two-way switches for control, and a mechanism for releasing cleaning liquid. The conclusion reflects on the successful development of an operational and efficient floor cleaning machine, suggesting potential modifications for future improvements, particularly in the scrubber design and the reduction of power consumption by using a single pump. Overall, the project aims to contribute to the automation of floor cleaning, particularly in Indian households, emphasizing ease of use and reduced human effort.

Prof. V. Dhopte et al[8], 2023 Increasing demand for automated cleaning solutions across diverse industries has led to the development of automatic floor cleaning machines. This project introduces a trolley-like structure equipped with electrical and electronic components, including sensors, motors, and a rechargeable battery. The machine features a mopping and water spray system, enhancing its efficiency. It maneuvers on ABS plastic wheels, and the mopping mechanism, powered by a motor, effectively cleans floors. The design incorporates dust and water storage tanks, utilizing a vacuum system to collect dust and fans for floor drying. The research highlights the machine's assembly, programming, and cost-effectiveness. Extensive testing confirms its effectiveness, suggesting potential improvements and additional features for future research. Overall, this

automatic floor cleaning machine presents a promising solution for enhancing cleanliness and reducing labor costs in various settings.

Vinod Kumar G et al[9], 2021 Focuses on the design and simulation of an innovative floor cleaning machine that integrates various cleaning mechanisms for enhanced efficiency. This automated cleaner incorporates a vacuum system, sprinkler system, brush, and drying mechanism to address drawbacks present in existing cleaning techniques. The simulation results in Autodesk Fusion 360 demonstrate the satisfactory performance of the machine's components, including the rotation of the brush, chain and gear mechanism for drying, and wheel movement. The model is designed with large vacuum chambers and water tanks for easy maintenance, and future work includes adding electronic components for full automation, reducing size and weight, fabrication, mobile application control, and market availability. The proposed floor cleaner presents a promising solution to improve cleanliness and reduce human effort in floor maintenance.

M. Sengottaiyan et al[10], 2021 The design and fabrication of an automatic floor cleaning machine, aiming to reduce cleaning time and manual effort. Key components include a scrubber, DC motor, water tank with a valve system, and wheels for mobility. The scrubber, coupled with the motor, efficiently cleans the floor, while a solenoid valve controls water supply for stain removal. The model focuses on simplicity, ease of operation, and cost-effectiveness. Addressing identified problems like vibrations during cleaning, difficulty on uneven surfaces, and water supply issues, the machine integrates a DC motor, Arduino microcontroller, and a 12V battery. The working principle involves the rotational motion of the motor-driven cleaning brush, aided by water absorption using a sponge roller. The project envisions an automatic, eco-friendly, and user-friendly floor cleaning solution that minimizes human effort and cleaning time, marking a significant step toward the future of efficient floor maintenance.

Rizwan Sheikh et al[11], 2019 The floor cleaning machine presented operates through the mechanical energy generated by pedaling, combining

sweeping and moping processes simultaneously. The front-mounted sweeper roller, detachable for easy cleaning, efficiently removes dust and debris, depositing them into a garbage duct. A tricycle design with two front wheels and a rear wheel ensures self-balance and stability, facilitating convenient handling. Power drives utilizing both chain and gear mechanisms contribute to mobility, with the operator initiating the process through pedaling, transferring energy to the rear wheel. The front axle, connected to the sweeper shaft through compound gearing, induces rotation for effective cleaning. This versatile machine accommodates both wet and dry floor surfaces, reaching corners with a 30" cleaning width per round. Water sprinkling, collected from a container and dispensed through a sprinkler system, precedes the mope's action, providing a finishing touch to the cleaning process. With a front axle speed of around 10 rpm and a sweeper shaft speed reaching approximately 188 rpm, the machine showcases practical efficiency. The tricycle's handle facilitates easy operation, making it a user-friendly cleaning solution. The successful integration of mechanical components, including the chain and gear drives, demonstrates a well-engineered system capable of addressing various floor cleaning needs. In conclusion, this pedaling-driven floor cleaning machine offers a stable and efficient solution, effectively combining mechanical power, thoughtful design, and versatility for comprehensive floor maintenance.

Roshan V. Dandage etal[12], 2019 The document outlines the significance of floor cleaning in various settings, emphasizing the importance of preventing injuries, enhancing aesthetics, and maintaining sanitary environments. It discusses methods for cleaning different floor types, such as wood, tile, and stone, providing specific instructions for each. The overview of existing floor cleaning machines highlights a design involving a rotary cleaning body, a water tank, and a garbage collecting tank. The types and uses of floor cleaning machines are briefly explored, emphasizing the principles of time, agitation, chemical use, and temperature for effective cleaning. Moving into the working principle section, the factors to consider when choosing a floor cleaning machine are detailed, including surface requirements, filter types, noise levels, storage considerations, and the relevance of attachments. The document then transitions to an overview of

vacuum cleaners for tile floors, addressing factors like cleaning surface requirements, filter devices, noise levels, storage, and attachments. The importance of choosing a vacuum with suitable attachments for flat surfaces, particularly tiles, is underscored. Overall, the content provides a comprehensive understanding of floor cleaning principles, existing machines, and considerations for choosing appropriate equipment.

Dr.Manoj Motghare etal[13], 2023 The significance of effective cleaning and disinfection in protecting human health, preventing pest infestations, and enhancing the durability of surfaces. It emphasizes the need for user-friendly cleaning methods and addresses the rising popularity of floor cleaning robots due to labor shortages, particularly among busy and aging populations. The focus shifts to the development of a manually operated floor washing machine in response to power crises in some regions, offering an alternative to traditional electrically powered machines. The project's objectives include achieving simultaneous dry and wet cleaning, cost-effectiveness, and reduced maintenance costs. The finite element method is employed in the design process. The importance of cleaning in hospitals, houses, auditoriums, and public places is highlighted, with a particular emphasis on reducing costs and maintenance. The proposed system involves a mechanically operated machine with minimal electrical components, providing a simple structure that can be easily used without prior training. The objectives of the project include reducing human labor, saving time, lowering costs, and preventing injuries caused by slipping or tripping. The proposed system utilizes a 12v DC battery, vacuum cleaner, DC motors, and an air dryer, controlled by a wired remote for efficient floor cleaning.

Mr. Nikhil M Chopade etal[14], 2022 Cleaning is a crucial aspect of modern living, particularly in households where floors require regular attention. Various techniques are employed for different surfaces, driven by reasons such as preventing injuries from slips, enhancing aesthetic appeal, removing debris and allergens, and maintaining a sanitary environment. Achieving a dry floor after cleaning is essential to avoid hazards. Traditional methods, like using sawdust for

liquid absorption, persist in certain settings. Modern floor cleaning machines, including buffers and scrubbers, expedite the process, each tailored to specific flooring types. The importance of cleaning extends beyond aesthetics, encompassing safety, health, and environmental considerations. The proposed modeling involves the construction of a floor cleaner machine, emphasizing the use of raw materials for weight reduction and ease of movement in the field. The process includes design, assembly, real-time testing, and modification based on trial and error. The machine incorporates components like a DC motor, battery, pulleys, brushes, belts, and a liquid flow system for efficient and controlled floor cleaning. The goal is to simplify and enhance the effectiveness of floor cleaning processes, particularly in agricultural settings.

Dhiraj M. Bankar etal[15], 2017 Effective cleaning and sanitizing play a crucial role in protecting human health and preventing pest infestations. Regular cleaning enhances the lifespan of floors and walls, especially in public places like bus stands and railway stations, where litter is common. The increasing preference for trains and buses for commuting necessitates frequent cleaning of these public spaces. The present work focuses on designing, developing, and evaluating a manually operated floor cleaning machine to address the need for less labor-intensive cleaning solutions in India, where unemployment is prevalent. The objectives of the manually operated floor cleaning machine include achieving simultaneous dry and wet cleaning, cost-effectiveness, ease of operation, no external power requirement, lower maintenance cost and time, reduced cleaning time, high cleaning capability, and covering more space in less time. The working methodology involves a fully mechanical operation, utilizing rollers, water tanks, sprocket and chain mechanisms, collector brush assembly, drive wheel, and cotton for cleaning. The machine's simplicity in construction, ease of operation, and low maintenance cost make it suitable for various environments, including hospitals and large areas, providing an efficient and cost-effective solution for floor cleaning.

Nitesh Bhoyarkar1 etal[16], 2022 The essential need for cleaning in the current generation, emphasizing the regular cleaning of household floors using various techniques. It focuses on an automatic and manual phone application controlled prototype cleansing machine, specifically designed for wet and dry cleaning with obstacle detection capabilities. The modern era demands autonomous cleaning solutions, and this project aims to develop a floor cleaning machine that reduces human effort through its vacuuming process. It utilizes ultrasonic sensors for obstacle detection, and a microcontroller (AT mega 328p) governs its operation, ensuring autonomous movement and cleaning. The machine facilitates both mopping and vacuuming, functioning in both manual and automatic modes. The design considerations include torque estimation, motor selection, power supply using lead-acid batteries, and the replacement of IR sensors with more accurate ultrasonic sensors. The thesis concludes with the successful design and proof-of concept for an autonomous floor-cleaning machine, integrating insights from literature studies and addressing challenges in each development stage.

Nikhil Murlidhar Chopade etal[17], 2017 The utility of floor cleaners in diverse settings, such as hospitals, houses, and shops, emphasizing simplicity and ease of operation. The machine incorporates a moisture cotton brush for floor cleaning, dried with a small blower, ensuring quick and cost-effective cleaning with minimal maintenance. The significance of well-maintained entrance matting is noted for dirt reduction. Various methods of floor cleaning are discussed, and the importance of ensuring floors are not left wet for safety is emphasized. Traditional floor cleaning instruments are mentioned, and the transition to modern cleaning tools, including vacuum cleaners, is explained. The historical evolution of floor cleaning includes the use of reciprocating brushes and the invention of the vacuum cleaner in 1868. The introduction concludes by mentioning the development of robotic vacuum cleaners in the late 1990s, enhancing autonomous cleaning capabilities in homes.

N.Sethuraman1 etal[18], 2018 Floor cleaning has been a significant occupation globally since ancient times, crucial for preventing injuries, protecting surfaces, and enhancing aesthetics. The objectives of a floor cleaner include simplicity, ease of operation, and cost-effectiveness, making it applicable in various settings. The historical evolution of floor cleaning machines dates back to the early 1900s, with divided-weight machines paving the way for faster and less strenuous floor polishing. The benefits of floor cleaning machines include improved worker productivity and reduced labor intensity. The need for floor cleaning is multifaceted, addressing injury prevention, aesthetic enhancement, and removal of debris, allergen control, and surface maintenance. Various floor cleaning methods, including the use of sawdust, tea leaves, and modern machines, cater to different floor types and cleaning requirements. The working principle involves a manual floor cleaner with a reservoir for cleaning liquid, a brush driven by manual power, and a lever-operated valve for controlled liquid application. The process is repeated to achieve well cleaned, smooth surfaces.

P. Vignesh etal[19], 2019 The smart floor cleaner is designed for manual floor cleaning with a motor source, reducing human effort and ensuring uniform cleaning in various areas. Its portability and automation make it suitable for larger spaces. Traditional floor cleaning methods involved cloths and mops, but this cleaner, equipped with a moisture cotton brush, enhances efficiency. The inclusion of a heating coil based on electromagnetic induction adds a drying element to the floor cleaner. The washing liquid stored in a tank is poured to facilitate the cleaning process. The motor rotates the brush and mop, applying pressure for effective cleaning, with cotton brushes preventing floor damage. The machine is user-friendly and beneficial for cleaning floors in hospitals, houses, auditoriums, shops, and public places. Cleaning, essential for individual and family health, involves various appliances. In India, floors are typically cleaned using scrubbers or mops, and the scrubber design is crucial for effective cleaning. The circularly shaped heating coil, generating heat close to the fan blade, contributes to the drying process, ensuring cleanliness. This floor cleaning machine's cyclic process involves motor-driven rotation, facilitating the cleaning of diverse floor types.

Overall, the machine is a cost-effective and efficient solution for floor maintenance.

Adithya A etal[20], 2020 The cleaning machine presented serves the purpose of efficiently cleaning various outdoor spaces, including cricket grounds and large areas, contributing to health and reducing manual labor. The working principle involves a frame housing a main wheel and a supporting wheel with a rotating brush, both mounted on bearings, along with a waste collection box. The main wheel propels the machine, simultaneously rotating the brush connected by a smaller wheel. Due to a diameter difference, the smaller wheel rotates ten times faster than the main wheel, enhancing brush efficiency. The sweeping brush moves opposite to the main wheels, collecting dust and waste from the floor, depositing it into the attached collection box. The collected waste is easily removed by inverting the frame, simplifying the cleaning process. The machine's simplicity and ease of operation make it accessible for anyone.

2.2 LITERATURE SUMMARY

Based on the literature, the following key points can be summarized

- The comparison of various floor cleaning machine, we found that using sensors for automation, manual operating, and semi automation cleaning machine are designed and operated.
- From the research papers, we can confidently say that reduce man power, cost efficient and maintenance cost of cleaning machine are identified by our floor cleaning machine using of electric motor setup with simple design

CHAPTER 3

METHODOLOGY

3.1 FLOWCHART

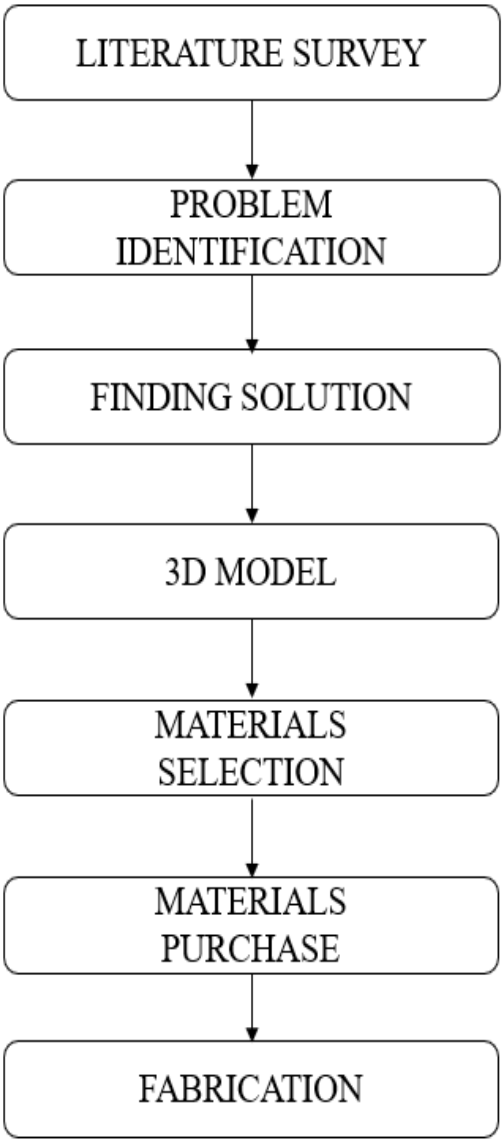

Figure 3.1 Methodology

3.2 PROBLEM IDENTIFICATION

• The present machine is very high cost.

• Now a days machines are required more maintenance.

• Only creamy people can buy high-cost machine.

• These are the problem identifications of a floor cleaning machine.

3.3 OBJECTIVES

- To reduce the Maintenance Cost & Man Power.
- To develop customer-friendly machine required less maintenance.
- To ensure profitable machine.
- To clean the sharp corners properly.\

3.4 CONSTRUCTION

The floor cleaning machine is designed with a central DC motor that drives its operation. At the heart of this setup is a v-groove pulley system connected to the shaft of the motor. This configuration ensures efficient transfer of power, enabling the mop to rotate seamlessly. The rotating mop is positioned to cover the majority of the floor surface, effectively cleaning it as it moves. To tackle the often neglected corners, the machine is equipped with strategically placed brushes. These brushes are designed to reach into tight spaces and dislodge dirt and debris, ensuring a thorough clean. The combination of the rotating mop and the corner brushes allows the machine to perform a comprehensive cleaning job. The simplicity of the v-groove pulley system, coupled with the power of the DC motor, ensures that the machine operates smoothly and reliably. Additionally, the use of a shaft to transmit power from the motor to the mop ensures that the cleaning process is both effective and efficient. This design not only simplifies the construction of the machine but also enhances its durability**.**

3.4 DETAIL ENGINEERING

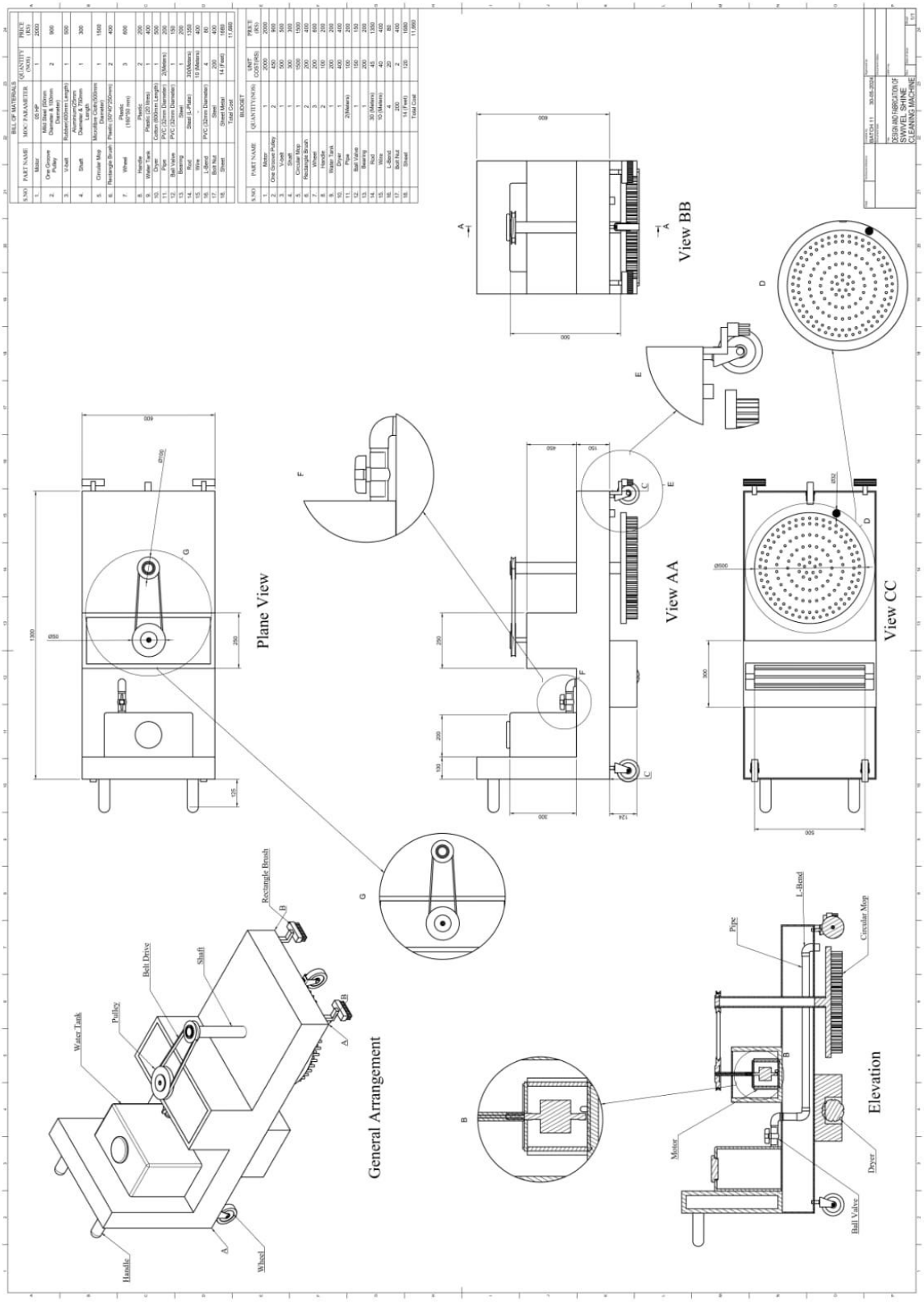

Figure 3.2 Detailed Engineering

3.4.1 Water Tank

Figure 3.4.1 Water Tank

The water tank in floor cleaning machines serves a multifaceted role that significantly enhances the efficiency and effectiveness of the cleaning process. Primarily, it stores and dispenses water, often mixed with cleaning agents, providing a steady supply of the cleaning solution needed to loosen dirt, grime, and stains on various floor surfaces. This functionality is crucial for maintaining continuous operation, especially in large spaces where manual cleaning would be inefficient and time-consuming. The controlled release mechanism ensures the optimal amount of liquid is used, preventing wastage and ensuring effective cleaning. Proper moisture levels help dissolve dirt and grime, making it easier for the machine's scrubbing brushes to lift and remove these contaminants, resulting in a more thorough cleaning compared to

traditional methods. Water also acts as a lubricant, reducing friction between the brushes and the floor, allowing for smoother and more effective scrubbing while capturing dust and small debris for collection by the machine's suction mechanism.

The water tank's ability to hold disinfectants and sanitizing agents is particularly important in environments where hygiene is paramount, such as hospitals and food processing facilities, ensuring that floors are not only cleaned but also sanitized to kill bacteria, viruses, and other pathogens. This dual-action cleaning and sanitizing capability is essential for maintaining sterile environments.

Modern floor cleaning machines, equipped with various cleaning modes, rely on the water tank to adapt to different requirements, whether deep cleaning with more water or light cleaning with less, thus providing flexibility and efficiency. These machines contribute to environmental sustainability by minimizing water usage without compromising on cleaning performance, promoting water conservation, and using water-based cleaning agents that are generally more environmentally friendly compared to solvent-based cleaners. Economically, the efficient use of water and cleaning agents reduces the need for frequent refills, saving time and labor costs, and achieving better results in a single pass reduces the need for repeated cleaning, thereby conserving resources and reducing operational costs. The design of water tanks also facilitates easy maintenance, with most being removable for simple cleaning and refilling, ensuring the machine functions optimally and extending its lifespan.

By maintaining the water tank properly, issues such as blockages or residue buildup, which could impede performance, are prevented. Safety is another critical consideration, as the controlled use of water prevents floors from becoming excessively wet and slippery, reducing hazards. Many modern machines include sensors and automated controls to monitor water levels and ensure safe, efficient operation. The versatility provided by the water tank

allows floor cleaning machines to adapt to different surfaces, such as tile, concrete, hardwood, and carpet, by adjusting the water output and type of cleaning solution, ensuring effective cleaning without damaging the floor material.

This adaptability makes these machines suitable for a wide range of environments, further enhancing their utility. In conclusion, the water tank is an indispensable component of floor cleaning machines, contributing to their functionality, efficiency, and versatility.

It ensures optimal water usage, supports various cleaning modes, promotes hygiene, facilitates maintenance, enhances safety, and provides environmental and economic benefits. As technology continues to advance, the design and functionality of water tanks in floor cleaning machines will further evolve, improving the effectiveness of these essential cleaning tools and ensuring they meet the diverse needs of modern cleaning requirements.

3.4.2 V Groove Pulley

V-groove pulleys are utilized in floor cleaning machines primarily due to their ability to enhance power transmission and operational efficiency, aligning

perfectly with the demands of these machines. The V-groove design significantly increases the friction between the pulley and the belt, ensuring minimal slippage and maximizing power transmission from the motor to the cleaning components. This is crucial in floor cleaning machines where consistent and reliable operation is essential for effective cleaning performance. The V-groove naturally aligns the belt, maintaining its position and preventing it from wandering off during operation. This ensures smooth and consistent power delivery, which is critical for maintaining the continuous movement of the brushes and other cleaning mechanisms. The stability provided by V-groove pulleys translates to fewer interruptions and a more efficient cleaning process.

Additionally, the V-groove design distributes the load evenly across the belt, reducing stress and wear compared to flat pulleys where the load is concentrated on a smaller area. This even load distribution extends the lifespan of the belts, leading to lower maintenance costs and reduced downtime, which is particularly beneficial in commercial and industrial cleaning settings where machines are in constant use.

The versatility of V-groove pulleys also allows them to accommodate different types of belts, including those specifically designed for heavy-duty applications in floor-cleaning machines. This adaptability makes V-groove pulleys suitable for various models and types of cleaning machines, ensuring that the pulley system can meet each machine's specific power transmission needs.

Furthermore, V-groove pulleys' efficient power transmission capabilities allow for more compact and efficient machine designs. In-floor cleaning machines, manufacturers can design more streamlined and lightweight units that are easier to maneuver and handle without compromising on performance.

The compactness also contributes to the machine's overall efficiency, allowing for better energy use and less strain on the motor and other components. The energy efficiency of V-groove pulleys is another significant

advantage. These pulleys reduce energy loss by minimizing slippage and ensuring that more of the motor's power is effectively transmitted to the cleaning components. This results in more effective cleaning and significant cost savings over time due to lower energy consumption, which is an important consideration for businesses operating multiple machines.

Moreover, V-groove pulleys are cost-effective in terms of both initial purchase and long-term operation.

Their simple design and the availability of various materials, such as steel, aluminium, and plastic, make them relatively inexpensive to produce. Their durability and reliability further reduce the need for frequent replacements and maintenance, contributing to overall cost savings.

In conclusion, V-groove pulleys are integral to the design and function of floor cleaning machines due to their superior grip, alignment capabilities, even load distribution, versatility, compact design, energy efficiency, and cost-effectiveness. These advantages ensure that floor cleaning machines operate smoothly, efficiently, and reliably, providing effective cleaning performance while minimizing maintenance and operational costs.

3.4.3 Rectangular Brush

Figure 3.4 Rectangular Brush

The rectangular brush in a floor cleaning machine is crucial for the efficient and thorough cleaning of floors, serving several essential functions that enhance the machine's overall performance. Positioned at the front of the machine, the brush's primary role is to agitate and loosen dirt, debris, and grime from the floor surface, preparing it for further cleaning processes.

This initial brushing action is vital because it breaks down stubborn dirt particles and lifts them from the floor, making it easier for subsequent cleaning stages to remove them completely.

The bristles of the brush are designed to penetrate into crevices and uneven surfaces, ensuring that dirt is dislodged from areas that might otherwise be missed. This is especially important in commercial and industrial settings where floors endure heavy foot traffic and accumulate significant amounts of dirt and grime.

The placement of the brush at the front of the machine allows it to tackle dirt immediately as the machine moves forward, ensuring that the area being cleaned is prepped for the water and cleaning solution that follows. This pre-cleaning action maximizes the effectiveness of the cleaning solution by ensuring it can directly contact and dissolve any remaining dirt without being obstructed by large debris.

The mechanical action of the brush complements the chemical action of the cleaning solution, providing a comprehensive cleaning approach that is both physical and chemical. Additionally, the brush helps to spread the cleaning solution evenly across the floor, ensuring consistent application and coverage. This is crucial for achieving uniform cleaning results, especially on large floor surfaces where manual application would be inconsistent and less effective.

The brush's design also plays a role in the overall maneuverability and efficiency of the cleaning machine. By loosening dirt and debris at the outset,

the brush reduces the load on the vacuum and suction mechanisms that follow, preventing clogs and ensuring that these systems can operate at peak efficiency.

This not only improves the cleaning performance but also extends the lifespan of the machine by reducing wear and tear on its components. Moreover, the brush helps in the initial removal of larger debris that might otherwise hinder the cleaning process.

By capturing and containing these particles, the brush prevents them from being spread across the floor, which would necessitate additional cleaning passes and reduce overall efficiency.

In environments where hygiene is critical, such as hospitals, kitchens, and food processing facilities, the brush plays an indispensable role in ensuring that floors are not only visibly clean but also sanitized.

The agitation provided by the brush helps to expose more surface area of the floor to the cleaning agents, enhancing their ability to kill bacteria, viruses, and other pathogens. This is essential for maintaining high standards of cleanliness and hygiene, which are crucial in preventing the spread of infections and ensuring safe environments.

Overall, the rectangular brush in a floor cleaning machine is a fundamental component that significantly enhances the machine's ability to clean effectively and efficiently. Its ability to agitate and loosen dirt, facilitate the even distribution of cleaning solutions, reduce the load on other cleaning mechanisms, and contribute to overall hygiene makes it an indispensable part of the floor cleaning process. Without the brush, the machine would be far less effective at achieving the deep, thorough clean required in many commercial and industrial settings.

3.4.4 . DC Motor

Figure 3.4 DC Motor

The motor in a floor cleaning machine is a pivotal component that drives the entire cleaning mechanism, and its central location, pulling the V-groove pulley to activate the mop's rotation, underscores its critical role in the machine's functionality.

As the heart of the machine, the motor provides the necessary power to initiate and sustain the operation of various cleaning elements, ensuring that the machine performs efficiently and effectively. Positioned centrally, the motor achieves an optimal balance, distributing power evenly and reducing strain on the machine’s structure.

This central location is crucial for maintaining stability and ensuring smooth operation, which is particularly important for achieving consistent cleaning results across different floor surfaces.

The motor's primary function is to convert electrical energy into mechanical energy, which is then transferred through the V-groove pulley system. This system is integral because it ensures the power from the motor is efficiently transmitted to the mop, facilitating its rotation. The V-groove pulley’s design enhances grip and minimizes slippage, allowing for consistent and reliable power transfer.

This efficient transmission is vital as it enables the mop to maintain a steady and powerful rotation, essential for scrubbing and cleaning floors effectively. The motor, through this system, ensures that the mop moves at the required speed and force, agitating the floor surface to dislodge dirt, grime, and other contaminants.

The ability of the motor to provide continuous and robust power is particularly necessary for floor cleaning machines used in commercial and industrial environments, where cleaning needs are intense and constant. The motor must be durable and capable of operating for extended periods without overheating or losing efficiency.

This durability reduces the likelihood of breakdowns and minimizes maintenance costs, ensuring the machine can meet the high demands of rigorous cleaning schedules. Furthermore, the motor’s power output directly impacts the cleaning machine’s ability to handle various types of dirt and floor materials. A powerful motor ensures that the machine can tackle stubborn stains and heavily soiled areas, providing a deep and thorough clean that manual cleaning methods would struggle to achieve.

In addition to driving the mop’s rotation, the motor also powers other essential components of the floor cleaning machine, such as the suction mechanism and water dispensing system. The suction mechanism relies on the

motor to generate the necessary vacuum to collect dirty water and debris efficiently.

This ensures that the dirty water is promptly removed after the mop scrubs the floor, leaving the surface clean and dry. The coordination between the motor-driven mop and the suction system is critical for preventing water from pooling on the floor, which could create slip hazards or lead to water damage.

The water dispensing system also benefits from the motor's power, as it ensures a consistent flow of water and cleaning solution onto the floor, enhancing the machine's overall cleaning effectiveness.

The central motor not only drives the mechanical components but also contributes to the machine's maneuverability. By maintaining a balanced distribution of weight and power, the motor ensures that the floor cleaning machine can be easily steered and controlled by the operator. This ease of use is essential for covering large areas quickly and efficiently, reducing the physical strain on the operator and increasing overall productivity.

In summary, the motor in a floor cleaning machine is indispensable for its operation, providing the necessary power to drive the V-groove pulley and activate the mop's rotation, along with supporting other critical functions like suction and water dispensing.

Its central location ensures optimal balance and efficient power distribution, enabling the machine to deliver consistent and effective cleaning performance. The motor's durability, power output, and ability to operate continuously are essential for meeting the rigorous demands of commercial and industrial cleaning, making it a vital component in ensuring floors are thoroughly cleaned and maintained.

3.4.5 Belt Drive

Figure 3.5 Belt Drive

The belt drive in a floor cleaning machine is a critical component that facilitates efficient power transmission from the motor to various moving parts, particularly the brushes and mop heads. Positioned between the motor and the V-groove pulleys, the belt drive ensures smooth and reliable transfer of mechanical energy, enabling the cleaning components to operate at optimal speeds. This system is essential for maintaining consistent rotation and scrubbing action, which are crucial for effective dirt removal and floor polishing.

One of the primary advantages of a belt drive is its ability to absorb shocks and vibrations, reducing wear on the motor and other mechanical parts. This absorption extends the lifespan of the machine and decreases maintenance requirements. Additionally, belt drives are known for their quiet operation, contributing to a more pleasant working environment, especially in noise-sensitive areas.

The flexibility of the belt allows for slight misalignments between components, enhancing the machine's durability and performance. Furthermore, the belt drive system is relatively easy to replace and maintain, making it cost-effective. Overall,

the belt drive in a floor cleaning machine ensures efficient, smooth, and quiet operation, enhancing the machine's effectiveness and longevity.

3.4.6 Driven Shaft with Mop

Figure 3.4.6 Shaft With Mop

The driven shaft with a mop in a floor cleaning machine is essential for converting the mechanical power transmitted through the belt drive into effective cleaning action. This shaft, connected to the V-groove pulley system and driven by the motor, rotates the mop head, enabling it to scrub and clean the floor surface. The driven shaft ensures that the mop maintains a consistent rotational speed and pressure, which is critical for loosening and removing dirt, grime, and stains from various types of flooring.

The necessity of the driven shaft lies in its ability to provide uniform and efficient cleaning. By ensuring the mop head rotates evenly, the shaft helps distribute the cleaning solution and water uniformly across the floor, maximizing the contact between the mop fibers and the floor surface. This consistent rotation also aids in the thorough agitation of contaminants, facilitating their removal and ensuring a more effective cleaning process.

Additionally, the driven shaft's design allows for the attachment of different types of mop heads, making the floor cleaning machine versatile and adaptable to various cleaning tasks. Its durability and reliable performance minimize

maintenance needs and enhance the overall longevity of the machine. In summary, the driven shaft with the mop is crucial for ensuring efficient, consistent, and versatile cleaning performance in floor cleaning machines.

3.4.7 Circular Mop

Figure 3.4.7 Circular Mop

The circular mop in a floor cleaning machine plays a crucial role in delivering thorough and efficient cleaning across various floor surfaces. Its design and operational features offer several advantages that enhance the machine's overall effectiveness, making it a preferred choice in many commercial and industrial settings.

Firstly, the circular shape of the mop allows for a 360-degree cleaning action, ensuring that every part of the floor is covered uniformly as the machine moves. This comprehensive coverage is essential for achieving consistent cleaning results, particularly in large areas where traditional manual methods might miss spots or leave streaks. The circular motion of the mop head also

facilitates the even distribution of water and cleaning solution, ensuring that these are spread uniformly across the surface, which helps in loosening and removing dirt, grime, and stains effectively.

The rotation of the circular mop is driven by the motor through a belt or direct drive system, which ensures that the mop head maintains a consistent speed and pressure. This consistency is crucial for scrubbing the floor effectively without causing damage. The rotational motion helps agitate the dirt and contaminants, lifting them from the floor surface and making them easier to remove. This is particularly beneficial for cleaning textured or uneven surfaces, where dirt can get trapped in crevices that a linear motion might miss.

Another significant advantage of the circular mop is its ability to maneuver around obstacles and into tight spaces. The mop's design allows the floor cleaning machine to clean efficiently around furniture, edges, and corners, areas that are often challenging to reach with larger or more rigid cleaning tools. This versatility ensures that the entire floor area is cleaned thoroughly, enhancing the overall hygiene and appearance of the space.

The circular mop is also compatible with various types of mop heads, allowing for customization based on specific cleaning needs. For example, microfiber mop heads are excellent for capturing fine dust and particles, while more abrasive materials can be used for heavy-duty scrubbing tasks. This adaptability makes the circular mop suitable for different floor types, from delicate tiles to robust concrete surfaces.

Furthermore, the circular mop's design often includes easy-to-replace mop heads, which simplifies maintenance and reduces downtime. Operators can quickly change mop heads when they become worn or when switching between different cleaning tasks, ensuring that the floor cleaning machine remains in optimal working condition and continues to deliver high-quality cleaning results.

In summary, the circular mop in a floor cleaning machine offers comprehensive coverage, consistent and effective cleaning action, excellent maneuverability, and adaptability to various cleaning needs. Its rotational design ensures thorough dirt removal and even distribution of cleaning solutions, while its compatibility with different mop heads allows for versatile use across different floor surfaces.

CHAPTER 4

DESIGN CALCULATION

4.1 V GROOVE PULLEY:

In v groove pulley system, the driver diameter & speed are known based on motor manufacturer. Determining the diameter of the driven shaft involves calculating the physical size of the mopping shaft based on the given rotational speeds and the size of the motor shaft.

N1 - Speed of Driver = 1000 rpm

D1 - Diameter of Driver = 100 mm

N2 - Speed of Driven = 670 rpm

D2 - Diameter of Driven =?

$$N_1 D_1 = N_2 D_2$$

$$D_2 = \frac{N_1 D_1}{N_2}$$

$$= \frac{100 \times 1000}{670}$$

$$D_2 = 150mm$$

4.2 DESIGN OF SHAFT:

Assume $\tau = 8\ N/mm^2$

Torsional Equation, $T = \frac{\pi}{16} d^3 \tau$

$$d^3 = \frac{T * 16}{\pi * \tau}$$

$$d^3 = \frac{(176.66\ X\ 10^3) * 16}{\pi * 8}$$

$$d = 48.26\ mm$$

From R20 Series: diameter ~ 50 mm

4.3 CIRUCLAR MOP:

Diameter = 500mm

4.3 RECTANGULAR BRUSH:

Length = 250mm

Breadth = 40mm

Width = 50mm

4.4 WATER TANK:

Water tank is store and supply water for diverse needs, ensuring a consistent and reliable source.

Capacity = 20 Litres

Diameter = 300mm

Length = 300mm

Height = 450mm

4.5 HANDLE:

Handle provide a convenient grip for controlling objects, enhancing usability.

Diameter = 50mm

4.6 WATER ABSORBER:

Length = 600mm

4.7 PVC PIPE:

Diameter = 32mm

4.8 WATER SPRAYER:

Diameter = 60mm

4.9 BEARING:

Ball Bearing - NSK 32205

Outer Diameter = 50mm

Inner Diameter = 25mm

4.10 MOTOR:

Half HP Motor

DC motor model: IA -180 -21

Rated power (Pe) - 18.5 KW

Rated Voltage (Ve) - 440 Volts

Rated Current (Ie) - 52 Amps

Rated Speed / maximum Speed (N max) - 600 to 1600 RPM

Moment of inertia - 1.72 kg.m²

4.11 WHEEL:

Diameter × Width = 160 × 50 mm

4.12 VALVE:

Ball Valve: Diameter = 32 mm

CHAPTER 5

Table 5.1 COST ESTIMATION

S.NO	ITEM DESCRIPTION	QUANTITY (NOS)	UNIT COST (RS)	PROPOSED COST (RS)
1.	Motor	1	2000	2000
2.	One Groove Pulley	2 Nos	450	900
3.	V - Belt	1	500	500
4.	Shaft	1	300	300
5.	Circular Mop	1	1500	1500
6.	Rectangular Brush	2 Nos	200	400
7.	Wheel	3 Nos	200	600
8.	Handle	2 Nos	100	200
9.	Water Tank	1	400	400
10.	Dryer	1	500	500
11.	Pipe	2 (Meters)	100	200
12.	Pipe valve	1	150	150
13.	Bearing	1	200	200
14.	Rod (L - Plate)	30 (Meters)	45	1350
15.	Wire	10 (Meters)	40	400
16.	L - Bend	4 Nos	20	80
17.	Bolt nut & Screw	200 Nos	2	400
18.	Sheet	14 (feet)	120	1680
TOTAL COST				11,660

Table 5.1 – Cost Estimation

CHAPTER 6
CONCLUSION

The study explores the complex historical development of floor cleaning equipment, highlighting significant changes in technology and functionality. It carefully looks at the problems that automated cleaning systems face, opening the door for the suggestion of a manual substitute that aims to fix common flaws. The goal of the manual cleaning machine is a invention that seeks to overcome frequent problems like the intricate design and high price tag of automated alternatives. This machine is a comprehensive solution since it combines wet and dry cleaning capabilities, has effective dust containment systems, and prioritizes simplicity of usage. Numerous studies have demonstrated its prospective advantages, highlighting its affordability and note worth advancements in environmental sustainability.

The ideas range widely, from complex robots controlled by Bluetooth to more basic functional pedal-operated devices. In conclusion, floor cleaning machines play a pivotal role in maintaining cleanliness and hygiene across diverse environments, offering efficiency, consistency, and adaptability in floor maintenance

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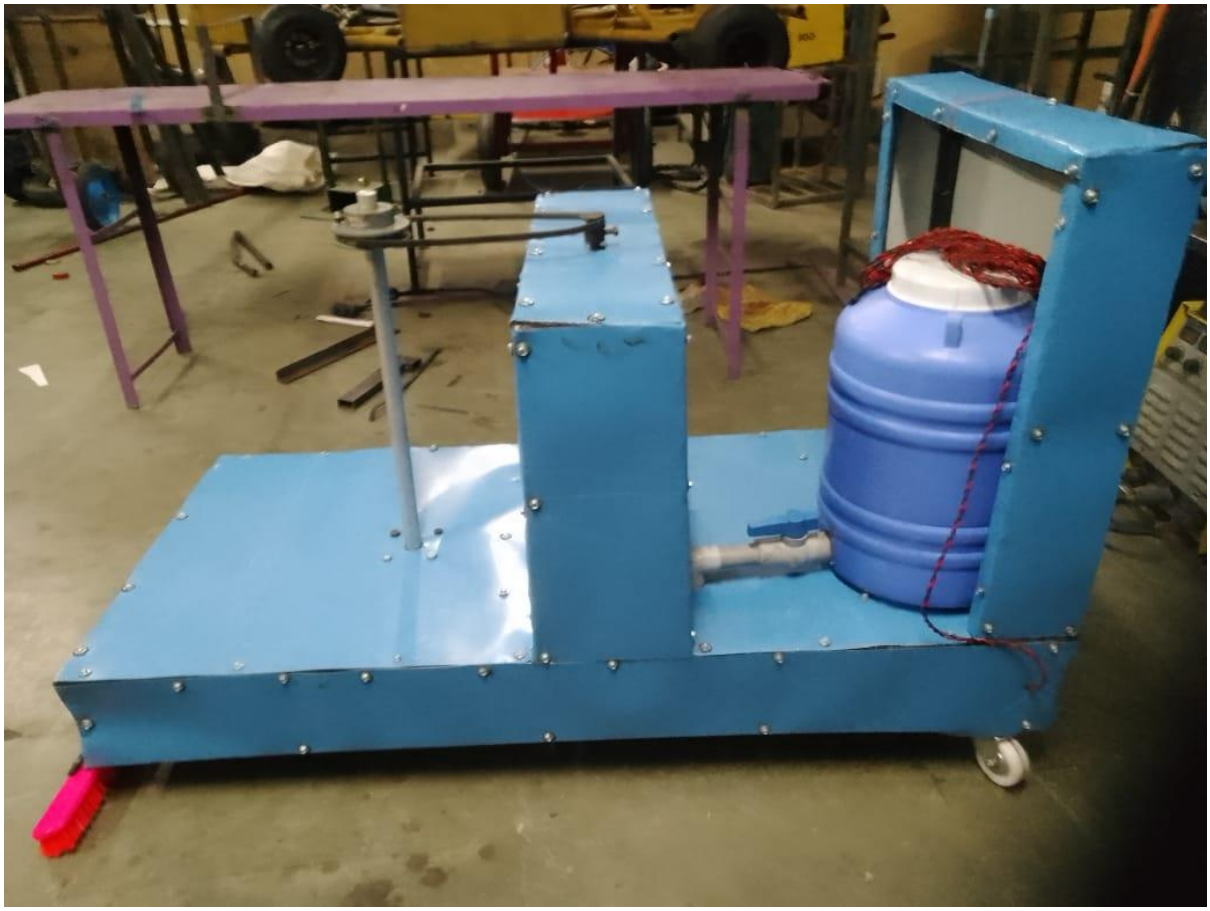
PHOTOGRAPHY



FABRICATED MACHINE